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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/748,821	12/30/2003	Koichi Ohto	NEC NE03P181	8951

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HAYES, SOLOWAY P.C.  
3450 E. SUNRISE DRIVE, SUITE 140  
TUCSON, AZ 85718

EXAMINER
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STARK, JARRETT J

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 06/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/748,821

Applicant(s)

OHTO ET AL.

Examiner

Jarrett J. Stark

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 03 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-13, 32-47 and 89-94 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13, 32-47 and 89-94 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/20/2006 12/30/03 1/25/05
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Allowable Subject Matter*

The indicated allowability of claims 1-13 and 32-47, and 89-94 are withdrawn in view of the newly discovered reference(s) to Grill et al. (US 2003/0235710). Rejections based on the newly cited reference(s) follow.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

**Claims 1-7, 32-45, 47, and 89-94 are rejected under 35 U.S.C. 102(e) as being anticipated by Grill et al. (US 2003/0235710).**

**Regarding claims 1-7, Grill et al. discloses an organic insulating film, wherein said organic insulating film is one selected from the group consisting of a SiCH film, a SiCHN film and a SiOCH film. (Grill, paragraph [0043]**

The breath of claims are directed to an organic insulating film particularly one selected from the group consisting of a SiCH film, a SiCHN film and a SiOCH film. All claim language directed to the method of forming the organic insulating

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film adds no patentable weight to the claims. Product-By-Process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps.

“Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (citations omitted) (Claim was directed to a novolac color developer. The process of making the developer was allowed. The difference between the inventive process and the prior art was the addition of metal oxide and carboxylic acid as separate ingredients instead of adding the more expensive pre-reacted metal carboxylate. The product-by-process claim was rejected because the end product, in both the prior art and the allowed process, ends up containing metal carboxylate. The fact that the metal carboxylate is not directly added, but is instead produced in-situ does not change the end product.).

**Regarding claim 32,** Grill et al. discloses a semiconductor device comprising, at least, one insulating film selected from the group consisting of an interlayer insulating film, an etching stopper film and a barrier insulating film against a metal; wherein said interlayer insulating film, etching stopper film or barrier insulating film against a metal is an organic insulating film; (Grill et al. paragraph [0018])

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wherein said organic insulating film formed using, as a source, a polyorganosilane whose C/Si ratio is at least equal to or greater than 5 and, at the same time, molecular weight is equal to or greater than 100. (product-by-process see regarding claims 1-7)

**Regarding claim 33,** Grill et al. discloses a semiconductor device according to Claim 32, which comprises a trench interconnection structure. (Grill et al. paragraphs [0005, 0031] and Figure 2 shown below)

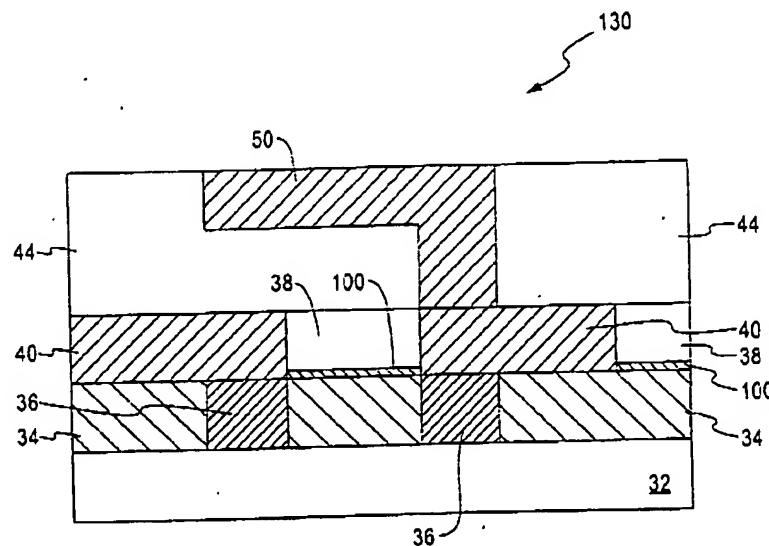


Figure 2

**Regarding claim 34,** Grill et al. discloses a semiconductor device having a trench interconnection structure, which comprises a first insulating film formed on a semiconductor substrate (Grill, Fig. 2 –[34]), a first trench interconnection formed in said first insulating film (Grill, Fig. 2 –[36]), a second insulating film (Grill, Fig. 2

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–[38]), a third insulating film (Grill, Fig. 2 –[44]), a second trench interconnection formed in said third insulating film (Grill, Fig. 2 –[50]), a via plug that is formed in said second insulating film and connects said first trench interconnection with said second trench interconnection (Grill, Fig. 2 –[40]); wherein (Grill et al. paragraph [0018] and Figure 2)

at least said first insulating film, said second insulating film and said third insulating film are each made of a SiCH film, a SiCHN film and a SiOCH film as set forth in Claim 7. (Grill et al. paragraph [0018] and Figure 2)

**Regarding claim 35,** Grill et al. discloses a semiconductor device according to Claim 34, wherein said first insulating film is a layered film made of said SiOCH film and a hard mask film. (Grill et al. paragraphs [0005, 0031] and Figure 5 shown below)

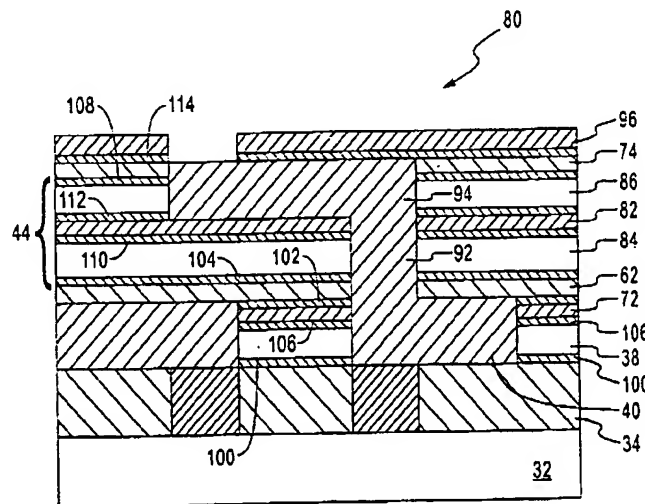


Figure 5

**Regarding claim 36,** Grill et al. discloses a semiconductor device according to Claim 34; wherein said first insulating film is a layered film made of an etching stopper film, said SiOCH film and a hard mask film; and said etching stopper film is either a SiCH film or a SiCHN. (Grill et al. paragraph [0020])

**Regarding claim 37,** Grill et al. discloses a semiconductor device according to Claim 34; wherein said second insulating film is a layered film made of a barrier insulating film, or a SiOCH film and a hard mask film; and said barrier insulating film is either a SiCH film or a SiCHN film. (Grill et al. paragraphs [0030-0031])

**Regarding claim 38,** Grill et al. discloses a semiconductor device according to Claim 34; wherein said second insulating film is a layered film made of a barrier insulating film and said SiOCH film; and said barrier insulating film is either a SiCH film or a SiCHN film (Grill et al. paragraphs [0030-0031])

**Regarding claim 39 ,** Grill et al. discloses a semiconductor device according to Claim 34; wherein said second insulating film is a layered film made of a barrier insulating film, said SiOCH film and an etching stopper film; and each of said barrier insulating film and said etching stopper film is either a SiCH film or a SiCHN film (Grill et al. paragraphs [0030-0031])

**Regarding claim 40,** Grill et al. discloses a semiconductor device according to Claim 34, wherein said third insulating film is a layered film made of said SiOCH film and a hard mask film. (Grill et al. paragraphs [0030-0031])

**Regarding claim 41,** Grill et al. discloses a semiconductor device according to Claim 34; wherein said third insulating film is a layered film made of

an etching stopper film, said SiOCH film and a hard mask film; and said etching stopper film is either a SiCH film or a SiCHN film (Grill et al. paragraphs [0030-0031])

**Regarding claim 42,** Grill et al. discloses a semiconductor device according to Claim 34; wherein a top section of said second trench interconnection is covered with a barrier insulating film; and said barrier insulating film is either of a SiCH film and a SiCHN film (Grill et al. paragraphs [0030-0031])

**Regarding claim 43,** Grill et al. discloses a semiconductor device according to Claim 36, wherein said etching stopper film is a layered film made of a SiCH film and a SiCHN film (Grill et al. paragraphs [0030-0031])

**Regarding claim 44,** Grill et al. discloses a semiconductor device according to Claim 37, wherein said barrier insulating film is a layered film made of a SiCH film and a SiCHN film (Grill et al. paragraphs [0018])

**Regarding claim 45,** Grill et al. discloses a semiconductor device according to Claim 34, wherein, at least, one of said trench interconnection and said via plug is formed of a copper containing metal. (Grill et al. paragraphs [0046])



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**Regarding claim 47,** Grill et al. discloses a semiconductor device according to Claim 34, wherein said trench interconnection and said via plug each comprise one or more barrier metal layers selected from the group consisting of layers of Ti, TiN, TiSiN, Ta, TaN and TaSiN. (Grill et al. paragraphs [0020-0021])

**Regarding claim 89,** Grill et al. discloses a semiconductor device according to Claim 36, wherein said etching stopper film is a layered film made of a SiCH film and a SiCHN film (Grill et al. paragraphs [0018])

**Regarding claim 90,** Grill et al. discloses a semiconductor device according to Claim 39, wherein said etching stopper film is a layered film made of a SiCH film and a SiCHN film (Grill et al. paragraphs [0018])

**Regarding claim 91,** Grill et al. discloses a semiconductor device according to Claim 41, wherein said etching stopper film is a layered film made of a SiCH film and a SiCHN film (Grill et al. paragraphs [0018])

**Regarding claim 92,** Grill et al. discloses a semiconductor device according to Claim 38, wherein said barrier insulating film is a layered film made of a SiCH film and a SiCHN film (Grill et al. paragraphs [0018])

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**Regarding claim 93,** Grill et al. discloses a semiconductor device according to Claim 39, wherein said barrier insulating film is a layered film made of a SiCH film and a SiCHN film (Grill et al. paragraphs [0018])

**Regarding claim 94,** Grill et al. discloses a semiconductor device according to Claim 42, wherein said barrier insulating film is a layered film made of a SiCH film and a SiCHN film (Grill et al. paragraphs [0018])

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 8-13 and 46 are** rejected under 35 U.S.C. 103(a) as being unpatentable over to Grill et al. (US 2003/0235710) in view of the following comments.

**Regarding claims 8-13** Grill et al. discloses an organic insulating film according to Claim 7.

It is well known in the art that the carbon to silicon ratio and density is a function of the gasses being fed into the plasma. For an example of this please see references listed on PTO-892 form.

It would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the workable or optimal value for the C:Si composition ratio and film density through routine experimentation and optimization to obtain optimal or desired device performance because the composition ratio and density is a result-effective variable and there is no evidence indicating that it is critical or produces any unexpected results and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05

Given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved. See *In re Aller*, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation." Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to

such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Appellants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. Ex parte Ishizaka, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. In re Burckel, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

**Regarding claim 46, Grill et al. discloses a semiconductor device according to Claim 45, wherein said copper containing metal further contains one or more metals selected from the group consisting of Si, Al, Ag, W, Mg, Be, Zn, Pd, Cd, Au, Hg, Pt, Zr, Ti, Sn, Ni and Fe. (Grill et al. claim 19- copper or alloy thereof)**

Grill discloses the claimed invention except for the materials used to form a copper alloy. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use any of the listed materials to form the Cu alloy, since it has been held to be within the general skill of a worker in the art to select a known material on the base of its suitability, for its intended use involves only ordinary skill in the art. In re Leshin, 125 USPQ 416.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jarrett J. Stark whose telephone number is (571) 272-6005. The examiner can normally be reached on Monday - Thursday 7:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JJS  
June 14, 2006

  
MICHELLE ESTRADA  
PRIMARY EXAMINER